

“Getting value from steam cracker C₄/C₅ olefin streams”

Marco Ferrari, Paolo Pollesel, EniTecnologie S.p.A., via Maritano 26, 20097 San Donato Milanese, Italia

Maria Angela Mantegazza, Polimeri Europa, via Fauser 4, 28100 Novara, Italia

ABSTRACT

An innovative catalytic cracking route to convert low-value C₄/C₅ olefin streams into a higher-value effluent stream, where propylene and ethylene are the main products, is described.

The proposed process is simple in principle, since it can be performed in a fixed bed reactor, with no steam co-feeding. It may be also defined flexible, both with reference to the feeds and the products: it can convert feeds deriving from steam cracking, as well from the FCC refinery unit; furthermore, it allows the variation of propylene to ethylene ratio, always remaining propylene the favoured product.

This paper describes the catalytic testing activity carried on in a lab scale fixed bed reactor, aimed at developing a catalyst, which is highly selective towards light olefins (especially propylene), and does not suffer from deactivation, even in the absence of steam. High silica ZSM-5 has been modified, with the goal to increase, starting from the earlier times on stream, the selectivity towards propylene and ethylene, without reducing the excellent time stability of the ZSM-5 itself. This is accomplished through the mitigation of ZSM-5 activity, which results in higher propylene.

Different synthetic feeds have been employed for the testing, in order to simulate a C₄/C₅ fraction coming from a steam cracking plant. These feedstocks compare linear, branched and cyclic olefins and paraffins, with a total olefin content ranging from 68 to 77 wt%. The ZSM-5 modified catalyst proves to be stable for at least 150h time of stream, at 525°C, WHSV=2 h⁻¹; the use of this catalyst increases the yields to both ethylene and propylene, as well as the propylene/ ethylene ratio, with respect to ZSM-5 itself, and to the propylene/ ethylene ratio from a naphtha steam cracker. Furthermore, the C₆-C₉ accumulation and BTEX production are reduced, which means a more stable catalytic activity, since the formation of the coke precursors is restricted.